

Structural Completeness of Identity and Interaction under the Λ -Principle

Abstract

We formalize the Nielsen–Semita Attractor Framework (NSAF) under the Λ -Principle of Irreducibility, showing that identity, interaction, and force-like phenomena emerge as artifacts of irreducible description-length tradeoffs between linear (L) and curved (C) frames. We prove a structural completeness theorem covering single-agent, multi-agent, and n-agent systems, with $1/f$ spectra as the universal equilibrium signature.

Definitions

****Definition 1 (Λ -Principle).** ** No finite description simultaneously minimizes length in both L and C frames.

****Definition 2 (Agent).** ** An agent is a linear-frame optimizer maintaining a boundary separating associated (self) from dissociated (environment) descriptions.

****Definition 3 (Boundary).** ** The irreducible interface across which association/dissociation inverts at scale limits.

Theorem 1 (Structural Completeness).

For any agent system (1, 2, or n agents), identity persistence, interaction, and apparent forces arise as boundary-maintained artifacts under Λ , and no further primitives are required.

Corollaries

1. Ship of Theseus persistence follows from boundary continuity under flow.
2. Cooperation/competition correspond to phase alignment/misalignment.
3. Learning equals boundary reclassification.
4. $1/f$ noise characterizes equilibrium across scales.

Game-Theoretic Mapping

Agents optimize local compression; global dynamics converge to NSAF attractors. Payoffs equal stability under irreducibility, not utility.

Implications

This framework unifies physics, cognition, and social dynamics without invoking fundamental observers or hidden variables.